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VIEWS, NEWS AND INTERVIEWS.

The man who made these remarks is not an employé of the railroad company, but he loafs around the Montgomery street power house in Jersey City and picks up points from the regular men. He has picked up so many that when he removes his hat his head is seen to be covered with bumps like the marks for a new set of quills on the outside of a hedgehog.

"Saw a great thing the other day," said the liar, and half a dozen men waited to yell "Rats!" if he sprang an old one.

"One of the electric motors came sailing along and stopped at Bergen avenue all right. The passengers had scarcely alighted when the trolley pole fell with a crash. The pin which holds the spring had dropped out. The motorman was told to run the car into the house. What did he do? Wait for the horses? No, sir. He just climbed to the roof of that car, and placing one foot on the plate caught hold of the wire with his right hand and yelled to the conductor to switch on the current. The car went along just as well as under the regular pole. Now I never see that man but I think of him as 'the human trolley.'"

The arrangements for the Paris International Exhibition of 1900 are already progressing. The area designed for exhibits will amount to about 4,500,000 square feet, of which 180,000 square feet will be reserved for electrical exhibits.

The Russian Government has sanctioned the building of a telegraph line from St. Petersburg to the Marman coast—a plan which has been advocated by various authorities. The expenditure is calculated at about 500,000 roubles.

"They say it's electricity," said Pat, as he stopped before the incandescent street lamp; "but I'll be hanged if I can see how it is they make the hairpin burn in the bottle."

A method of electrical heating by which the temper of a Harveyized armor-plate at any given point can be drawn and made soft enough to permit the drilling of bolt-holes without affecting the surrounding surface has been devised at the Homestead plant of the Carnegie Steel Company, and has been successfully tested in the Cramp shipyards. Before the method was introduced it was necessary to leave unhardened an entire strip of the plate, six inches in width, rendering it at such points penetrable by projectiles.

The past six months has marked an epoch in long distance telephoning in the South. The line between Atlanta and Macon was opened November 24, 1894. This line is copper metallic circuit of finest construction and 103 miles long. The line from Madison to Athens, completed December 3, 1894, which joins the line already established between Atlanta and Madison, makes another first class line of 114 miles, connection being had through Atlanta to Macon, making a No. 1 metallic circuit of an unbroken stretch of 217 miles. This is but a forecast of what is to come. Mr. W. T. Gentry is the enterprising manager at Atlanta, and contemplates with much satisfaction these additions to the telephone system of the Southern Bell Telephone and Telegraph Company.

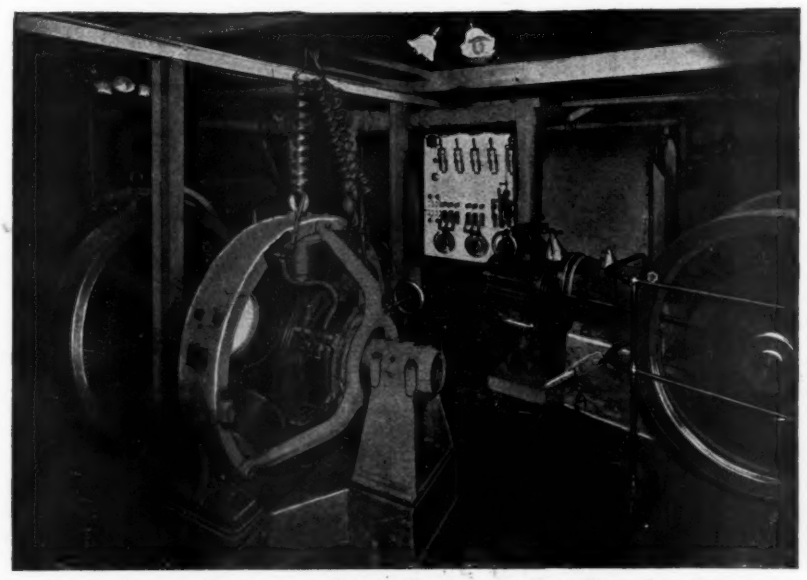


FIG. 1.—INTERIOR VIEW OF THE DYNAMO ROOM OF THE FALL RIVER LINE STEAMER "PRISCILLA."—(See page 50.)

The Great Northern Telegraph Company has notified the Commercial Cable Company that messages to Yokohama take seven hours and 59 minutes in transit, and to Shanghai seven hours and 11 minutes.

G. Winthrop Coffin, of Boston, and William H. Stevens, of Detroit, are said to be principals in an enterprise which has for its object the building of an electric plant at Ontonagon River falls. It is believed that the falls can generate enough electric power to work all the abandoned copper mines in that vicinity.

An order has been received by a Delaware iron company for 500 tons of iron trolley poles for Dublin, Ireland, and Bristol, England.

The executive committee of the American Bell Telephone Company has decided to sell the 3,300 shares of Bell Telephone stock not taken by stockholders at auction on February 9.

THE ELECTRIC LIGHT CONVENTION.

Cleveland, February 19, 20 and 21, The Place and Time.

EASTERN DELEGATIONS WILL GO FROM NEW YORK, BOSTON, PHILADELPHIA, BUFFALO, ROCHESTER AND SYRACUSE—THE RAILROAD ARRANGEMENTS — A SPECIAL TRAIN FROM NEW YORK—MANY LADIES EXPECT TO ATTEND.

Everything relating to the arrangements for the Cleveland meeting of the National Electric Light Association is progressing swimmingly. Secretary Porter was in Cleveland last week stirring things up and Master of Transportation C. O. Baker, Jr., is sitting up nights dallying with the railroad arrangements. Mr. Baker is always blessed with an equal number of friends and enemies on a special train—the enemies in the upper berths and the friends in the lower. But this doesn't phase him and he intends to provide as fine a special as he can get from the railroad officials.

There is some discussion as to whether the train from New York shall leave in the morning or late in the afternoon. The most acceptable idea to many appears to be that a special train running as a second section to the Empire State Express over the New York Central road and leaving at 8.30 A. M., Monday, February 18, would be about the right thing.

On this plan the delegates going from points in New York State could be picked up, whereas if the special ran through the State at night this would not be so convenient. Such a train would reach Albany about noon on Monday, where the Boston crowd would be met. The Bostonians would reach Albany about 8 o'clock

Monday morning, and it is hoped that arrangements can be made to entertain them in that city during the time between their arrival and the arrival of the New York special.

By leaving New York at 8.30 Monday morning, the train could reach Cleveland about 11 o'clock the same night, which, to many persons, seems to be more desirable than arriving early in the morning on Tuesday.

A large number of ladies may be expected to attend the convention, and it looks now as if the special train will have to accommodate from 125 to 150 people. This will include a number from Philadelphia, who will come over and join the New York party. About a carload of delegates is expected from Boston.

Staterooms in the parlor cars reserved for the gentlemen are already at a premium, but it is understood that they are being held in reserve for delegates suffering from "la grippe" and who need the careful attention of four or five faithful friends.

The entire programme cannot, at this writing, be definitely announced, but it may be said that the papers will be especially interesting, the discussions full and intelligent, and that the local entertainment committee is doing its best to provide relaxation for the odd hours between the business meetings.

In addition to the list of papers already published, there will be one by Nelson W. Perry, entitled "Storage of Energy Essential to Central Stations: How It May Be Accomplished and the Economies Resulting." Discussion by Professor Langley, of Case School; Professor Stine, Armour Institute, Chicago, and others. The topic, "How to Light Large Cities," will be discussed by Frederic Nicholls, Charles R. Huntley, Frank H. Clark, J. Frank Morrison, T. Carpenter Smith, George A. Redman, E. F. Peck and others.

Messrs. E. P. Roberts & Company, electrical and mechanical engineers, Brainard Block, Cleveland, have established a bureau of experts who will take charge of any exhibits which may be entrusted to their care. They have issued a circular describing this scheme. A copy of it can be had by writing to them at Cleveland.

General Electric Company Issues a Warning.

The following resolutions were passed by the board of directors of the General Electric Company on January 22:

"Various printed statements (favorable and unfavorable) regarding the company and its business have heretofore appeared, most of them reading in a manner calculated to give the impression they are either issued with the sanction of this company or from information furnished by its officers or directors; and whereas, in point of fact, and almost without exception, such statements, if made, are unofficial, and, while often having some foundation in fact, are so inexact as to be to a great extent misleading;

"Now, therefore, be it resolved, that the board of directors desires to caution the public against assuming that any casual statements, whether favorable or unfavorable, emanate from sources competent to furnish information respecting this company.

"Resolved, further, that this board now state for the information of stockholders that the company is entirely free from floating debt. Since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for the purpose the proceeds of various accounts and assets, which have been liquidated since the date of the said report."

Standard Underground Cable Company.

The Standard Underground Cable Company held its annual meeting on Tuesday, January 22, 1895, at Pittsburgh, and the old board of directors was re-elected as follows: George Westinghouse, Jr., Mark W. Watson, J. W. Dalzell, James H. Willock, John B. Jackson, George B. Hill, John Moorhead, Jr., Robert Pitcairn, Joseph W. Marsh.

The gross business for the year 1894 was $963,464, which is an excess of $101,551 over the business for the year 1893. Out of the net profits for the year, the company paid four quarterly dividends of one and one-half per cent each, or $60,000 in all. The capital stock is $1,000,000, fully paid up, with a surplus of $531,000. The company has practically no debts, except for current purchases for the months of December and January.

The Brooklyn Police Telegraph System.

So quietly and effectively does the police telegraph system of the widely-extended city of Brooklyn answer every demand that is made upon it that the extent of its work is not appreciated. Supt. Frank C. Mason has won high honors for this department, which he has brought to its present position of unsurpassed excellence. During the first seven days of the great Brooklyn strike, 23,000 messages were transmitted over the wires of the police telegraph system in addition to transacting the regular department business, often aggregating 500 messages a day. Supt. Mason and his efficient staff have been on duty night and day during the strike, and their work notably deserves this word of praise. During the year 1894 the telegraph bureau handled 208,314 messages, but, owing to the annexation of the suburban towns and the present strike troubles, the total for this year will be far in excess of last year's record.

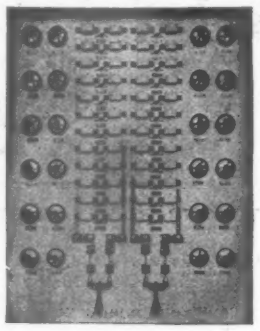


FIG. 2.—ONE OF THE JUNCTION BOXES ON THE "PRISCILLA."

FIG. 3.—LIGHTING FIXTURES IN THE DINING ROOM OF THE "PRISCILLA."

Westinghouse vs. Stanley.

In the United States Circuit Court at Boston on January 22, Judge Carpenter overruled the plea in bar set up by the respondent in the equity suit of the Westinghouse Electric and Manufacturing Company against William Stanley, Jr. The suit is brought for an injunction to restrain the defendant from an alleged infringement upon patent No. 469,809, granted March 1, 1890, for an improvement on a system of electrical distribution.

THE ELECTRICAL EQUIPMENT OF THE "PRISCILLA."

AN UNUSUALLY FINE MARINE INSTALLATION.

In the issue of the ELECTRICAL REVIEW for May 9, 1894, we gave a short description of the electrical installation on board of the latest constructed Fall River Line steamer the "Priscilla." We are now able to supplement this in detail and to present to our readers some views which are for the first time made public.

The "Priscilla" is without doubt the finest side wheel passenger boat ever constructed and exemplifies the very high degree of excellence which has been attained in the naval art. Designed by Mr. George Pierce, Supervisor of Steamers of the Old Colony Steamboat Company, built by the W. & A. Fletcher, Company of Hoboken, and electrically equipped by the General Electric Company, she is a model of perfection—architectural, mechanical and electrical. Every detail of construction betrays the master hand. Nothing has been omitted which could add to the traveler's comfort, and more care has been bestowed upon her interior illumination than many other passenger carrying steamer afloat.

She is made just narrow enough to admit her to the widest dry dock in New York. Her double hull is of steel, and milled steel enters into every part of her construction, this skeleton work of steel rendering the "Priscilla" one of the staunchest of marine craft. Her dimensions are as follows:

Length over all, 440 feet, six inches; length on water-line, 423 feet, six inches; breadth over guards, 93 feet; breadth of hull, 52 feet, six inches; depth of hull, 20 feet, six inches; tonnage, 5,398.

The steam plant consists of 10 boilers of the Scotch return tubular type, each having three corrugated furnaces giving a total grate surface of 850 square feet. They are constructed for a working pressure of 150 pounds per square inch, are arranged for natural or forced draught, and have an indicated capacity of 8,500 horse-power. They furnish steam to a huge double inclined compound engine having two 51 inch high-pressure cylinders forward and two 95 inch low-pressure cylinders aft of the crank shaft. The piston stroke is 11 feet. The engine room is lighted from electroliers and bulk head fixtures, 129 lights in all.

The electric equipment of the "Priscilla" forms the most extensive isolated marine electric lighting plant ever installed. It consists of three 50 kilowatt 275 revolution General Electric multipolar dynamos, each directly connected to a 11x12 Harrisburg Ideal engine with outboard bearings supplied by W. R. Fleming & Company. These engines operate both condensing and non-condensing. Each generator has a capacity of 400 amperes at 120 volts. The armatures are of the ironclad type, the windings being embedded in slots in the body of the armature. The brushes are operated simultaneously by means of a hand wheel. The dynamo and

engine room measures in all 12½ feet by 25½ feet.

The output of the generators is carried to a switchboard of white marble framed in mahogany. This is an extremely handsome specimen of the switchboard work to which the General Electric Company has given so much attention recently. At the base of the board three hand wheels operate three fire-proof field rheostats located behind it. Above these are three dynamo switches flanked by two voltmeter switches and over these are five main switches. A Weston illuminated dial voltmeter stands on each side of the board, and three 450 ampere circular dial ammeters arranged in a line along the upper portion.

The vessel is wired on the two wire system. From the switchboard five feeders run to the main deck, and at four points of the vessel risers mount to the upper decks. These are connected to the circulating mains, one of which is on each deck, by means of four center of distribution safety fuse holders to each circulating main. At six points on each circulating main whence the smaller wires branch off to the state rooms, saloons and dining rooms are set marble cut-out panels of special design,-each having its own peculiar form to fit it into the position it can most conveniently occupy. These are provided with knife blade switches, which bring the current to two strips of flat copper, between which are set fuse carriers of porcelain. Connection is made behind the board with a snap switch on the front for every circuit. The fuse carrier is a small porcelain box in which the fuse is fastened by set screws to two projecting pieces of flat copper. The cover of the box is lined with mica and secured by a copper pin. Should the fuse blow the metal cannot by any chance escape. There are 25 panels in all. Those on the saloon and gallery decks are set on the transoms of the doors of the side passages, those in the dining room under two of the sideboards, that in the engine room facing the engines and the others where they can best be placed. The two largest are those in the engine room and on the gallery deck, both of which control 24 circuits. Ten lamps on each circuit is the limit of the load of that circuit.

All the wiring appliances used have been especially devised by the General Electric Company to meet insurance and government requirements. All junction boxes, switches and cut-out boxes used on the deck and other exposed places are absolutely water-tight. Where the wiring is exposed to moisture the wire is lead covered, and all wire larger than No. 6 Brown & Sharpe is stranded. Forty-five miles of wire in all are used on the vessel. The wire used is a special white core marine wire, having an insulation consisting of first a layer of pure para rubber, next a layer of rubber devoid of sulphur, which is finally covered with a layer of vulcanized rubber containing 30 per cent of para rubber.

FIG. 4.—SHOWING HOW THE QUARTER-DECK OF THE "PRISCILLA" IS LIGHTED.

A series of charts showing the location of each circuit, each light and each appliance adorns the walls of the engine room.

Two combination ventilating sets, each consisting of a two horse-power motor directly connected to a No. 4 Sturtevant, are also installed on the "Priscilla."

The purpose of this elaborately conceived and carefully installed marine electrical plant is the illumination of the "Priscilla." Starting with the entrance hall or quarter-deck we find the light proceeding from tulips set in the capitals of eight stanchions which support the roof. Each tulip is of opalescent glass set in a polished ornamental brass frame work, and contains 12 incandescent lamps.

Leading from the quarter-deck is a vestibule, lighted by ceiling fixtures, which gives access to the dining room. This is a spacious room running aft. Over each window is a box, with stained glass sides, holding ten 16 candle-power lamps, and similar boxes are placed over the doors and mirrors at each end of the room. The ceiling is divided into square panels, each having a medallion in the center, and each alternate panel holding an electric pendant—an elliptical opalescent glass bowl held in a rope net of brass and containing two 16 candle-power lamps. Six rows of these extend from end to end of the room. On each side of the sideboard aft are two niches, in front of each of which hangs a basket pendant. The two private dining rooms are each lighted by five elliptical bowl fixtures, set in the panels immediately over the tables. The number of lights in the dining room is 350.

Passing from the dining room and recrossing the quarter-deck, access is gained by a staircase to the main saloon, the ceiling of which is partly open, showing the roof of the dome. The lighting other than from the dome is effected by three light electroliers set between the stanchions and a series of two light brackets set between the stateroom doors. The mast passing up through the saloon carries an ornamental fixture at the height of the gallery deck. In this the branches bend down and out from a central band and carry at their terminals frosted incandescent lamps set in opalescent globes.

At the forward end of the saloon is the grand staircase leading to the gallery deck. Facing this is a mantel of a highly ornate character, framing a mirror, on each side of which is a four light bracket. The passages on each side of this are lighted by lamps fixed to pretty sprays, and each stateroom is provided with a one light bracket.

The principal feature of the lighting from the dome is a central fixture which takes the form of an inverted dome of brasswork, in which are framed panels of opalescent glass. This is dependent from the ceiling half-way between the bulkhead of the staircase and the mast. In this dome are 48 incandescent lamps. It occupies the center of a quadrangular medallion, on each side of which is a much smaller inverted opalescent dome. Further aft is a smaller center dome with two lesser satellites, and still further aft another single dome. Starting at the bulkhead is an inverted ridge of frosted lights set in the ceiling, the sockets being hidden in metal tulips. This ridge breaks into a quadrangle around the large central fixture, a circle round the mast, a narrow quadrangle around the second dome fixture and a circle around the third. In the forward saloon two 8 light electroliers are the main features.

FIG. 5.—THE DOME LIGHTS ON THE "PRISCILLA."

The gallery saloon benefits from the lighting just mentioned. In addition it has one 12 light electrolier in the forward saloon and a row of 12 incandescent lamps around the mast.

Forward of the gallery saloon are the cabins of the president, captain and principal officers, lighted by electroliers and brackets. The cabins of the lesser dignitaries and the pilot house are on the dome deck, and are lighted by one light brackets. All the fixtures are in polished brass.

The lighting of the decks and all other parts of the vessel is effected by means of lanterns, some hung as pendants, others arranged horizontally, and all protected by cages. Wherever moisture can reach them they are protected by water-tight globes and sockets.

The lighting is distributed as follows:

Dome deck,	9 circuits,	55 lights;
Gallery deck,	68 circuits,	596 lights;
Saloon deck,	44 circuits,	360 lights;
Main deck,	78 circuits,	748 lights;
Lower deck,	12 circuits,	92 lights;
Hold,	18 circuits,	136 lights.

Total, 229 circuits, 1,987 lights.

The entire electrical equipment of the "Priscilla" was effected by the General Electric Company, whose work in this direction has obtained a very high reputation. This company also installed the plants on the sister ships of the "Priscilla"—the "Puritan," "Plymouth," "Pilgrim," and "Providence." All the fixtures were designed and constructed by the General Fixture Company of this city.

INCANDESCENT LAMP VERSUS WELSBACH BURNER.

READ BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, MILWAUKEE, JANUARY 16, 1895, BY WM. GOETZ.

The hitherto triumphant progress of incandescent electric lighting has of late encountered an obstacle which may prove a serious one in the future, if the various promoters of this most perfect art of illumination do not use adequate means to remove it. The obstacle I refer to is the Welsbach incandescent gas burner, and it shall be the object of this paper to point out to station managers and contractors some of the defects of this uninvited guest, thus enabling them to show him the door at the earliest possible moment. Before doing so, I may say that the very limited space of time that has been accorded me for the preparation of these lines has prevented me from giving the matter as close a study as would have been necessary and desirable. I have also been unable to make any tests, and for the correctness of some of the data given hereafter have had to rely on reports published in the gas papers and on statements made by the promoters of the Welsbach burners. The so-called incandescent gas burner was invented in Germany, by Dr. C. A. von Welsbach, and that by the new discovery gas lighting has entered upon a new epoch can hardly be denied. The main point of the invention is that immediately the gas is lighted the light giving body or mantle is raised to a high degree of incandescence without forced pressure or alterations of existing fittings. The gas is supplied through a special form of atmospheric or Bunsen burner, which can easily be attached to fittings already in use. The flame thus produced is non-illuminant, and the combustion almost complete with a consequent considerable diminution of the smoke and dirt which accompanies the use of gas in the ordinary way. Experiments with this burner have been made for the past seven years, but only during the last two years has the same been so improved that it has become quite a competitor for the incandescent lamp. Notwithstanding the inclination of some of our friends, among whom I may mention Mr. Foree Bain, who has discussed this matter in a recent issue of the *Western Electrician*, to treat this matter lightly by simply calling it a fad, I do not think that the expression dangerous is exaggerated, for there is no doubt but that the Welsbach burner offers advantages which, to say the least, are and have been an inducement to many consumers to install this light. It not only does away with two of the principal objections to ordinary gas burners, insufficient light and flickering, but it also materially lessens the cost to the consumer. The latter point may be illustrated by the following data, which, although procured from the enemy's camp, I think are nearly correct:

One Welsbach burner using about 3.2 cubic feet of gas per hour gives about 60 candle-power, and is, therefore, the equivalent in candle-power to about 3¾–16 candle-power lamps. Assuming the price of gas to be $1 per metre foot, and of electric light .01 cent per ampere hour, we would obtain the following result: One Welsbach 60 candle-power light, consuming 3.2 feet per hour, costs $\frac{3}{10}$ cents, and 3¾ 16 candle-power lamps, consuming 1⅞ amperes per hour, cost 1⅞ cents. Now, it is evident that, although the figures relating to the Welsbach burner are only obtainable under the most favorable conditions, that is, with a gas of high thermal power and a new mantle of the very best material, the difference is sufficiently large to induce many people to install this wonderful illuminant without going to the trouble of considering any other points, and the effect these figures have already had can be seen by the fact that an alarmingly large number of these burners have already been introduced throughout this country. In many cities you will see in stores, show-windows, small hotels, and, in fact, wherever running expenses are an important item, combination fixtures where the incandescent lamps are out of commission and where the gas outlets, which formerly were not in use, have been fitted with Welsbach burners. The people who so readily installed those lights at the rate of $2.50 apiece would perhaps not have done so had they taken into consideration that the monthly gas bill is not the only item of expense connected with this light. Mantles are apt to give out frequently, renewals costing 50 cents, and the glass chimneys are subject to breakage, while mica chimneys, although unbreakable, become smoked and must be thrown away. Almost in every instance the breakage of a chimney means the breakage of a mantle also, and the economy of the Welsbach is, therefore, not quite as striking as may appear to the casual observer. Fortunately for the incandescent lamp, it has never been price and quantity which resulted in its almost general adoption at a time when the cost of current was twice as high as it is to-day, and it is high time to bring to the remembrance of all parties interested the fact that something else than candle-power alone should be considered when contemplating the installation of the most satisfactory, and, at the same time, most economical light. One of the reasons why the Welsbach burner does not comply with the former condition is its color. The bare statement that a light is of so many candle-power really conveys no accurate information at all. Artificial light is generally produced by raising some body to a high temperature. As soon as the temperature is sufficiently high, it parts with some of its energy in the form of radiation. At first, the radiations are not of a kind to which the eye is sensitive; they are of a greater wave length than red light and may be called infra red. As the temperature increases, the infra red radiations increase, and presently there are added radiations which the eye perceives as red light, and, subsequently, while the red light increases, yellow, green, blue, and violet rays are successively thrown off. The rays of the incandescent lamp, similar to those of the candle, are largely composed of red and yellow, while those thrown off by the Welsbach burner combine an abundancy of green and blue, and those of an arc lamp all of these colors, with violet added to them. In other words, while the temperature of the filament of an incandescent lamp, when burning at its rated voltage, is such as to generate as large a proportion as possible of such rays as are most pleasant for the human eye; that of the Welsbach mantle, being considerably higher, will cause the production of rays containing a larger proportion of yellow and blue rays than is desirable for a majority of indoor purposes. I have heard numerous complaints from people who have used the light for some time to the effect that it ruined their eyes, acknowledging that they made a mistake in putting it in. I note from *Electricity*, of December 19, 1894, that it was tried in the show-rooms of Dorflinger Bros., the leading American cut-glass makers, and would have ruined the business of the company if it had been long continued. The purest and whitest of the product was made to look as green as the cheapest grade of window glass, and the electric light was soon reinstalled. In the issue of December 12, of the same paper, we find the following statement, made by B. Altman & Company, one of the leading dry goods concerns of New York: "Some time ago, we allowed an agent of the Welsbach people to put on a few burners, but the light was of a yellowish glimmer, trying to the customers and unsuitable for a proper showing of colored fabrics, so we decided not to purchase the burners, which were removed. We do not know whether any gas was saved, as we made no tests."

The following opinions were given by Bowery merchants: "The Six Little Tailors" said: "It is generally admitted that we have the handsomest tailoring establishment in the city, and at night it is brilliantly illuminated with electric lights. We were offered a lot of Welsbach lights free of charge, but declined the offer with thanks, as the effect of the light upon our goods would have been unsatisfactory. We want the best light going and we have it."

"The Original Harris Cohen" said: "We have no time for the Welsbach burner; it takes two men and a boy to monkey with it in a large store like ours. We tried it last year and gave it the G. B."

Wherever complaints about the ghastly glare have been made, the gas companies or the promoters of the Welsbach burners have tried to remedy matters by fitting the lamps with frosted or opal shades, for some of which even the shape of the incandescent bulb has been adopted. This was an improvement, but, of course, caused an enormous reduction in candle-power, and also in the diffusive capacity of the light. I cannot understand why, in cases where such extreme brilliancy is required, incandescent arc lamps, which can be run for less money, should not be preferred. By using them, consumers who do not consider quality, but simply want the highest candle-power for the least money, can avail themselves of all the advantages offered by the Welsbach, without the addition of heat, breakage, poisoned atmosphere, etc. To illustrate this, let us follow the methods used by the gas companies.

Two incandescent arc lamps in series on 110 volt circuit, giving 2,000 candle-power each and using 10 amperes of current, cost 10 cents per hour. To obtain the same candle-power about 67 Welsbach lights would have to be installed, which would consume 214.4 feet of gas per hour and would cost 21.44 cents, or more than twice as much as the arc lamps. This simply goes to show how ridiculous such figuring is and what results can be obtained thereby. However, it seems from the foregoing that the Welsbach burner may, to some extent, be a competitor of the arc lamp, but, although giving more candle-power for the money, will not stand comparison with the incandescent lamp, whose mild rays and agreeable light nobody can possibly find fault with, if central station managers do their duty to the public. The old adage, "too much of a good thing," applies pre-eminently to the Welsbach burner as far as indoor lighting is concerned. What people want nowadays is plenty of light of the best quality, and the pear-shaped bulb fills the bill in a manner which cannot be improved. Of course, station managers should do all in their power to prevent their customers from finding fault with the quality of the light furnished. The almost general habit of leaving lamps on the circuits until the filaments give away ought to be discontined, and the lamps ought to be exchanged as soon as the candle-power drops below the normal. First-class apparatus, an intelligent distribution, plenty of copper, and a sufficiently high pressure at the station will do away with all other causes of complaints. There is no reason why, with the present price of incandescent lamps, station managers should endeavor to save a few cents and to prolong the life of the lamps by running them below their rated voltage; nor does it seem to be good business policy to charge 40 cents apiece for lamps where the consumers stand the cost of renewals. A little liberality in this respect would lessen the danger of any other illuminant receiving the preference, and would undoubtedly largely increase the list of customers. Another claim advanced by the Welsbach people as an inducement is the cheapness of installation. Now, it is almost impossible to make any comparisons in this respect, as the cost of installing electric lights is dependent upon different circumstances in each and every case. I may say, however, that to wire a store or office or a similar place for incandescent lamps, the wire to be concealed under moulding, or mounted upon insulators, and the lamps to be suspended by means of flexible cord, costs about one-half what it would cost to have existing gas fixtures fitted with Welsbach burners. It is a well-known fact, at least to the majority of those present here, that wiring of this description is usually done for about $1 a light, while the cost of installing Welsbach burners is at least $2.50 apiece. Where new electric fixtures are to be installed, it is only fair to compare the cost with that of new gas fixtures, and the result would be about the same. Add to this the extreme unsightliness of this burner, including glass chimneys, corrugated opal shades and holders and the impossibility of throwing the light in the direction it is usually most wanted—that is, downward—and you will have to acknowledge that cost, notwithstanding the points, are all in favor of the glow lamps. I have not dwelled upon another objection to the Welsbach, an objection of a very serious nature, as it involves sanitary principles, because being common to all gas burners and not special to the Welsbach, it does not properly belong under the head of this paper. I mean vitiation of the atmosphere. Although we all know that it is unhealthy to breathe the air of a room that is lighted by gas, it would be interesting to find out just to what extent the air in a room of a given size is vitiated by ordinary gas burners and by the Welsbach burners, and to what extent health is impaired thereby.

Whatever defects have been pointed out, the claims made by the gas light people are sufficiently enticing to the casual observer to warrant our friends to be on their guard. Although I do not think that the Welsbach burner has come to stay, or that the present competition will be lasting, the members of the electrical fraternity ought to declare war against it without further delay. Much can be done during the next few months, while the advent of Summer, when the surplus of heat furnished by these miniature gas stoves is not needed, will certainly relegate them to where they belong—the ash barrel.

A CURIOUS MAGNETIC PHENOMENON.—II.

BY JOHN S. STONE.

In the ELECTRICAL REVIEW for January 9, 1895, I made some comments on the interesting results Mr. C. O. Lloyd obtained by mapping the field of a broken magnet. I merely pointed out what the position of the neutral axis should be in a broken uniform magnet under various possible conditions as to the reluctance at the juncture of the two parts.

Since the publication of the above, I observe that Mr. W. B. Burnie, of the Central Technical College, had been led to make an experimental investigation of the phenomenon observed by Mr. Lloyd. His results are even more interesting than those obtained by Mr. Lloyd, and though

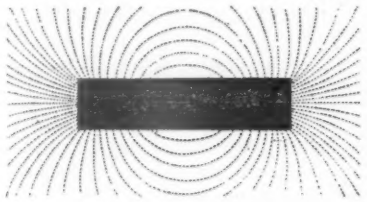


FIG. 2.—DIAGRAM SHOWING LINES OF FORCE IN A UNIFORM MAGNET.

they constitute a satisfactory explanation of the latter, they are in themselves so unique and unexpected as to demand further explanation.

Mr. Burnie's observations may be summed up as follows: A number of fairly long straight steel bars were powerfully magnetized by a variety of processes and the field mapped in the ordinary manner with iron filings. The result in every case was substantially that shown in Fig. 1, and an investigation of the hardness of the bar showed that though the magnet may be readily scratched with a given piece of steel between the points A and B, beyond these points it resists scratching. Furthermore, when subjected to a mechanical strain, the magnet shows a tendency to break at the points A and B.

The field of a short bar magnet or of a long bar moderately magnetized by any of the processes he used is fairly uniform, being substantially represented by the diagram in Fig. 2, and the magnet presents none of the peculiarities described above, or else they are possessed in so slight a degree as not to have attracted attention though they may now possibly be detected.

The above consideration points conclusively to the hypothesis that the phenomena observed are due to the action of the field upon the magnet, and further since it is known that a magnetic field produces a mechanical stress in the steel and that a mechanical stress in the steel causes it to become eolotropic, it might be suspected that the observed phenomena are connected in this manner with the magnetization of the bar.

From a consideration of Fig. 2, it will be seen that in an isotropic bar uniformly magnetized, the core or central portion will tend to elongate and contract laterally; whereas the surface portion will tend to contract longitudinally and expand laterally. The result will be a shearing stress, and the outer layers of the magnet will be under great tension longitudinally except throughout a region near the neutral axis of the magnet. The tendency of the core of the magnet to elongate will also be resisted by the outer layers, and the core will, therefore, be subjected to a compressive stress. The effect of those stresses upon the steel will be to make it eolotropic, and the degree of the action will depend upon the intensity of the magnetization.

Since the material is steel, it should be expected that the permeability longitudinally of the outer layers would be diminished, while that of the core is increased.

This reasoning when pushed to its ultimate consequences indicates a distortion of the field of force of a fairly long steel magnet, resembling the distortion observed by Mr. Burnie, and it is a significant fact that this same reasoning indicates that the steel at and beyond the points A and B in Fig. 1 is under great mechanical stress, thus incidentally suggesting an explanation of the phenomena of unequal hardness and tensile strength at symmetrically disposed points along the magnet.

In the above, no mention has been made of the possible effect of the stresses on the *coercive force* in determining the distribution of magneto-motive force in the magnet. Perhaps the best reason that could be given for not doing so is the absolute futility of attempting to apply *a priori* reasoning to such an action, but on the other hand, the methods of magnetizing the bar employed by Mr. Burnie would seem to preclude any but a linear distribution of the force.

The whole matter of the explanation of these phenomena on the basis of internal mechanical stresses must remain an hypothesis until further experimental evidence is adduced to show that the mechanical stresses,

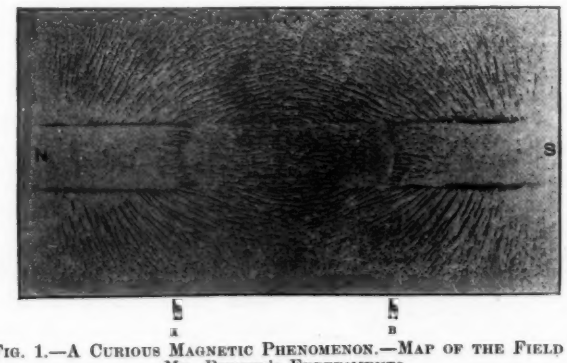


FIG. 1.—A CURIOUS MAGNETIC PHENOMENON.—MAP OF THE FIELD IN MR. BURNIE'S EXPERIMENTS.

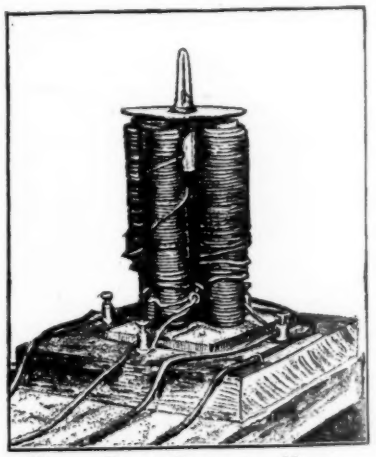
which we know are produced in the material of the magnet, are sufficiently great to cause modifications in the reluctivity of the steel capable of so greatly distorting the field of force of the magnet.

An admirable exposé of current American practice in the line of direct connected engines and dynamos is given by Thomas G. Smith, Jr., in *Cassier's Magazine* for February. A large number of illustrations are given, showing most strikingly the latest achievements in this field.

THE FIRST POLYPHASE MOTOR.

BY PROF. S. P. THOMPSON, D.SC., F.R.S., IN LONDON "ELECTRICIAN."

Amidst the crowd of modern inventions little note has been taken of the modest beginnings of the polyphase motor, the birth of which dates from 1879. By the kindness of Mr. Walter Baily I am able to describe the elementary motor which he exhibited to the Physical Society of London, on June 28, 1879, on the occasion of his reading a paper entitled "A Mode of Producing Arago's Rotations."



WALTER BAILY'S POLYPHASE MOTOR (1879).

Down to that date the only mode of producing the Arago rotations of a copper disk had been by rotating beneath it a steel magnet. Baily, instead of rotating any material magnet, fixed it; but caused its magnetism to shift progressively between four successive poles, thus producing in the copper disk pivoted above them eddy currents, which by their reaction gave the disk a mechanical motion in the direction of the progression of the poles.

The disk in this primitive model is about two and three-eighth inches in diameter; the four magnet cores are about four inches high, joined to a common yoke; and each is wound with about 150 turns of insulated copper wire 2.5 millimetres in diameter. The coils are connected two and two in series, like two independent horseshoe magnets set diagonally across one another. The two circuits are brought down separately to an ingenious revolving commutator built up of a simple arrangement of springs and contact strips mounted on a bit of wood, with a wire handle by which it is turned. On rotating it the currents from two batteries are caused to be reversed alternately in the two circuits, giving rise to the following successions of polarity in the four poles:

N O N N O N S N S O
O S S S S O S N O N

and so forth. Mr. Baily had very clear views as to how far this really represented a rotatory magnetic field. His own words are as follows:

"The rotation of the disk is due to that of the magnetic field in which it is suspended, and we should expect that if a similar motion of the field could be produced by any other means the result would be a similar motion of the disk

"Possibly the rotation of the magnet may be the only practicable way of producing a uniform rotation of the field; but it will be shown in this paper that the disk can be made to rotate by an intermittent rotation of the field effected by means of electro-magnets." The author then goes on to discuss the result of the increase in strength of a pole while a neighboring pole of the same sign decreases in strength, and suggests that if a whole circle of poles were arranged under the disk, and successively excited in opposite pairs, the series of impulses all tend to make the disk move in one direction around the axis; adding: "In one extreme case, viz., when the number of electro-magnets is infinite, we have the case of a uniform rotation of the magnetic field, such as we obtain by rotating permanent magnets." He then returns to the case of his actual model with two pairs of poles *a a'* and *b b'*, and points out that if the *b b'* pair are arranged to be reversed before the *a a'* pair, the rotation will be in one direction; whilst, if the *b b'* pair are reversed after the *a a'* pair the rotation will take place in the other direction. He goes on to show how the reversal of the direction of rotation may be effected either by reversing the action of the commutator, or by reversing the connections of one of the two batteries. The diagram accompanying the original paper suggests that the cores should be of laminated iron, but those of the actual model are solid. In a final paragraph the author remarks that the effect on the disk might be much increased by placing four other electro-magnets above the disk, each opposite one of the lower magnets, and connected with it so as to present an opposing polarity.

The model runs exceedingly well when four dry cells are used to excite the electro-magnets.

On the occasion, now 15 years ago, when the paper was read and the model shown, the late Professor Guthrie asked jokingly how much power it was expected that the motor would give. To which Mr. Baily modestly replied that at present he could only regard it as a scientific toy.

The Edison Electric Illuminating Company of Boston has declared a regular quarterly dividend of one and one-half per cent, payable February 1 to stock of record January 21. Books reopen February 2.

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There has been for several weeks an earnest desire in the electrical field for that decision in the Bate refrigerator case. It is still on ice.

Remember the date of the next Electric Light Convention—February 19, 20 and 21. Cleveland is the hospitable city that will welcome the apostles of light.

WHAT A PATENT IS.

A patent is a writing granted by a sovereign power, which secures to an inventor for a term of years the exclusive right to his invention. A United States patent grants to the inventor a monopoly of his invention for a term of 17 years, and if this term does not grant to him a sufficient opportunity for remuneration the term may be extended by special act. The prime object of a patent system is to foster and promote the inventive faculties of a nation. Beyond and above this is an utilitarian purpose. It is that after the inventor has been granted a monopoly of his invention for a limited period, during which he is supposed to take advantage of the opportunity to reward himself for his labors, the invention becomes public property and the people at large are thereby benefited. Any attempt to thwart these fundamental principles, if successful, works harm not only in the special case in which it is made, but militates against the whole system by setting up an example which encourages other such attempts.

The wire-burying epidemic has become contagious in the cities of the second and third class. Telephone and electric light companies should meet the question bravely, and working together secure reasonable and proper time and conditions for this work. In some cities the expense will be excessive—out of proportion to the extent of the business—and in others the change can be made without great difficulty, because of the compactness of territory, and consequent concentration of service. In all cases, we think, when the change has once been made, the companies as well as the public will have cause to rejoice.

The complete report of the Brooklyn trolley strike, which appeared with truthful illustrations in the ELECTRICAL REVIEW last week, was evidently much appreciated by our street-railway readers. Officers of other large companies have been watching this strike with great interest, and the graphic, unbiased narrative in the REVIEW was the first complete account to reach them.

Although the oldest electrical weekly, the ELECTRICAL REVIEW is not suffering from old age. In fact, it feels quite young and vigorous and happy.

From the announcements it is evident that the next convention of the Electric Light Association will have a feast of good things in its addresses.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

Wall street this week has been sliding down the hill it so laboriously climbed during the first two weeks in January, having failed to reach the top and to establish values on a higher plane. The underlying cause of the weakness in prices was the very serious phase of the currency situation which developed. Exports of gold during the first half of January were heavy, and promise a continuance, but the movement this week has exceeded all calculations in point of size, having amounted to $7,766,000. Accompanying this movement have been withdrawals of gold from the Treasury far in excess of export requirements, which were undoubtedly made by bankers and others who are trimming their sails for a possible financial storm. The amount so taken has been $13,955,000, reducing the Treasury gold reserve to about 56½ million dollars. A promise of a continuance of the movement has stirred the lethargic blood of the Administration and created activity among eastern financiers. As a result a number of plans are being considered which promise a speedy solution of the very important and vexed question, probably through a small issue of bonds calculated to tide it over the gold exporting period. It is because of this feeling that something tangible will be done next week that the bears stopped selling stocks on Thursday and Friday and a fractional recovery in values occurred.

More or less important news developed in the electrical-financial world during the week. General Electric furnished its quota. The directors, in view of the many contradictory reports concerning the property current of late, authorized a statement which confirms that made in this column a week ago, to the effect that since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for the purpose the proceeds of various accounts and assets which have been liquidated during that time. The further statement is made that the company is free from debt. The stock was exceedingly steady all the week between 33 and 34.

It is surprising to note the cat-like vigilance with which Wall street watches for the Bate refrigerator decision. It is fully aware of its bearing upon the incandescent lamp patent, and is prepared to trade heavily in the stock when the terms become known. The February recess in the Supreme Court, of one month duration, taken for the purpose of allowing judges to write their opinions, leaves only two Mondays in which a decision can be handed down. In view of the fact that the case was tried several months ago, the general belief is that had it been decided, it would have been announced before this, and that in view of the delay the decision can hardly be expected until after the recess or until sometime in March.

The Street Railway and Illuminating Company declared a semi-annual dividend of three per cent on the

preferred stock, payable February 1 to stock of record of January 23.

Edison Electric Illuminating of New York advanced a point or more, reaching 102 on the good showing made in the annual report. The following facts set forth in that document, not heretofore published, follow: Gross earnings in the year increased 17½ per cent and net increased 30 per cent. The Duane street station is capable of supplying nearly four times the present amount of current. The chief expense of the future will be for additional generating apparatus and underground conductors. The uptown district showed a heavy increase in demand for current, and an annex was put up on Twelfth street, which will increase the capacity. The company will consider this year extensions of the system west of Central Park. After paying 6 per cent dividends the company has carried $125,000 to depreciation reserve fund, practically reducing the cost of plant that amount.

The Edison Electric Illuminating Company has declared a quarterly dividend of 1½ per cent, payable February 1 to holders of record of January 21.

The New England Telephone Company, on the 23d instant, declared $1 per share, payable February 15 to stock of record January 31. Books close February 1 to February 15.

On the Boston Exchange, Bell Telephone was quiet at 196, Erie Telephone unchanged at 51¼ to 52¼, and New England Telephone a shade stronger at 69. The quotations on Westinghouse were 32 to 32½ on the common and 49½ to 50 on the preferred. BAIN.

New York, January 26, 1895.

ELECTRIC LIGHT FLASHES.

An electric light plant will be built at Millstadt, Mo.

Lancaster, N. Y., is about to start an electric light plant.

Saginaw, Mich., is considering the advisability of establishing a municipal electric light plant.

Gladstone, Mich., has appointed a committee to secure figures on a municipal electric light plant.

The owners of the electric lighting plant of Bath, N. Y., offer to sell out to the village for $22,000. The proposition is under advisement.

The electric light plant at Portland, Conn., has temporarily suspended operations, owing to complications caused by the death of its principal stockholder.

At the annual meeting of the Edison Electric Light Company, of Philadelphia, the usual eight per cent dividend was declared, and the directors were re-elected.

A fire is smouldering in the coal bunkers of the electric light station at Gloucester, Mass. After failing to drown out the fire, teams were set to work transferring the 800 tons of coal to another place.

OBITUARY.

RUDOLF EICKEMEYER.

Rudolf Eickemeyer, one of the foremost citizens of Yonkers, N. Y., died in Wormley's Hotel, Washington, D. C., on January 23. Mr. Eickemeyer left Yonkers on January 12 to go South for his health, accompanied by his son Carl and his daughter-in-law. Mr. Eickemeyer stopped at Washington on business with the Patent Office, and while there he became ill. He had been a sufferer from asthma for a number of years. He was born in Bavaria and fought in the revolution of 1848. In 1850 he came to the United States and four years later settled at Yonkers, where he lived up to the time of his death.

Soon after Mr. Eickemeyer's arrival in Yonkers he established a tool repairing factory. He became familiar with the hat trade and set to work making machinery for the manufacture of hats. His first invention was a machine for making leather hat bands which is used throughout the world. A few years afterward he constructed the first sewing machine used to sew the leather into the hats. Among other inventions used to-day in nearly all the large hat factories are hat blocking machines and pouncers. The royalties received from his inventions of hat machinery made him a very wealthy man.

Mr. Eickemeyer was an electrical inventor of ability. The Eickemeyer dynamos and motors are remarkably efficient machines and possess many points of novelty. One of the earliest direct-connected sets for lighting railway trains consisted of a Brotherhood engine and an Eickemeyer dynamo. His motor is extensively used for operating the Otis electric elevators. The Eickemeyer armature winding is a very ingenious construction and has been used, under royalty, in a large number of machines made by the General Electric Company.

In connection with Stephen D. Field, Mr. Eickemeyer developed an electric railway system of considerable merit. This was manufactured by the Eickemeyer-Field company, which was afterward sold out to the General Electric Company. For many years Mr. Charles Proteus Steinmetz, now of Schenectady, N. Y., worked with Mr. Eickemeyer, especially in connection with his work on alternating current apparatus.

Mr. Eickemeyer was a prolific inventor and had a large file of personal diaries in which he kept records and drawings of his inventions as they developed in his mind or as the result of experiment. Photographs of pages of these diaries were often used in patent suits and several times proved to be of the greatest value in establishing dates and other important details.

In 1872 the Common Council of Yonkers appointed Mr. Eickemeyer one of a committee of citizens to procure a water supply for the city. He was elected president of the water commissioners, and held the office up to the time of his death. A widow and six children survive him.

RUDOLF EICKEMEYER.

OUR BOSTON LETTER.

A project is on foot for the construction and operation of an electric road between Greenfield and Turner's Falls, Mass. Stock to the amount of $6,000 has already been subscribed, and it is claimed that a syndicate stands ready to take up the balance immediately. The success of the project will necessitate the building of a new bridge across the Connecticut River at Montague city.

The National Telephone Company of this city have recently been asked to ship some of their instruments to the Interior Department at Washington for inspection and comparative tests. There is a little inside history behind this which may prove interesting in its bearing on a big contract soon to be placed by the government. In September last bids were asked for on a complete telephone outfit for the Interior Department. Mr. J. D. Leatherbee, the treasurer of the National company, lost no time in bringing the merits of his instruments before the authorities, and in consequence the bids were not accepted, new ones being asked for two months later, the National Telephone Company receiving specifications. They were asked to furnish a bond protecting the United States Government from any trouble on the ground of infringement. A reply was made to the effect that unless this clause was eliminated the company declined to put in a bid, and at the same time suggested that it would be well to wait a few days for Judge Carpenter's decision on the Berliner patent before closing matters definitely. About the time this letter was written the decision was handed down and now comes the request for National instruments to be forwarded regardless of specifications. In the meantime, the whole matter remains in abeyance at the Interior Departpartment in Washington, and none of the bids previously submitted have been accepted.

An order was introduced in the Common Council Thursday night which, if its terms are carried out, will prove of considerable interest in Boston electrical circles, and especially to the West End Street Railway Company. It is to the effect that the Mayor be requested to petition the General Court at its present session for the passage of an act compelling the West End Company in part compensation for the use of the streets in the city of Boston to furnish power for the electric lighting of all streets in which their tracks are located. It also provides that they shall not only furnish power for those already in operation, but for any new ones which may be erected in the future, in such localities as may be designated by the superintendent of lamps; the lamps, poles and all other necessary equipments to be furnished by the city, and the care and maintenance of them to be under the charge of the superintendent of lamps. It is claimed that the extra expense to the West End company will not be very great, but undoubtedly that corporation will entertain different views on the subject. The Boston Electric Light Company now have a contract with the City for street lighting which runs until 1899, and they also will have a word to say against the proposed legislation. The lamp department of the city now has under its care nearly 3,000 lamps, but the demand for electric lights is so great that this number will probably be increased 50 per cent within the next four years. It is claimed in support of the new order of things that the West End road has an income of $47,000 a year from the advertising company whose signs are carried in their cars, and that this is one of the many reasons why they should be willing to contribute towards the expenses of the city whose streets they occupy without remuneration. In some quarters this movement is looked upon as a first step towards municipal ownership, and it is said that the tendency is towards the city doing its own electric lighting. Allowing that this is so the city may count on having a long and up-hill fight before they can bring the West End company into line on any proposition of this kind. H. G. T.

Boston, January 26.

ON THE UNITS OF LIGHT AND RADIATION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK AND CHICAGO, JANUARY 16, 1895, BY A. MACFARLANE, D.SC., LL.D.

One of the recommendations made by the sub-committee of the Institute in the programme for the International Electrical Congress at Chicago was that the practical unit of illumination should be defined as the illumination produced by the bougie-decimale at the distance of one metre, and that this unit should be denominated the bougie-metre. To this definition little objection was made, excepting that Professor Nichols pointed out that it involved an arbitrary standard of light which had no relation to the C. G. S. system of units. More general objection was taken to the notation for the unit.

The London *Electrician* for February 3, 1893, objected to the "bougie-metre," that all other such compound names imply a product of the components, while in this case the former component is divided by the latter, or, more correctly, multiplied by the square of its reciprocal, and suggested, half seriously, that instead of "candle-foot" we ought, on the "mho" principle," to speak of "candle-toof-toof."

M. Hospitalier made the same objection, that "bougie-metre," according to existing usage, means a product, and suggested "bougie-at-a-metre," or, if that were inadmissible, the use of a new term, such as "lux." M. Blondel favored the single term "lux," and Mr. Lockwood the single term "davy."

Consider the philosophy of the substitute suggested by the *Electrician*. If we attempt to formulate the "mho" principle, we find that it may be expressed as follows: The reciprocal of a given unit may be denoted by writing the name for the direct unit backwards. It supposes that the given unit can be expressed as the ratio of two other units; thus, ohm is the single name for the ratio, volt per ampere. The reciprocal idea is ampere per volt, and there is a convenience in not introducing a new and independent word, but in denoting it instead by the direct term written backwards.

It appears to the writer that here we have a principle which might well be adopted in mathematical analysis, for we have all felt the want of a suitable notation for a function, which is the reciprocal of a given function; for example, the reciprocal of *tan* or *sin*. English and American writers use tan^{-1} and sin^{-1}, a notation which is half word, half symbol; which cannot be pronounced; and which suggests the reciprocal quantity instead of the reciprocal function. Continental writers use "arc tan" and "arc sin," which are too long and periphrastic. On the "mho" principle, the reciprocal of "tan" is "nat" and that of "sin" is "nis." Let $x = \tan y$, then $y = \text{nat } x$; let $a = \sin b$, then $b = \text{nis } a$. According to Lord Kelvin, who, I believe, introduced the "mho" notation, the expression for a function should consist of three letters; and it may be added, the middle letter ought to be a vowel, the other two consonants. Such a syllable notation when inverted remains a syllable. This notation would have the advantages of being short, unambiguous, articulate and logically connected.

But in the case of a fundamental unit, such as the foot, is there any reciprocal idea? It is true that there are physical quantities which have the dimension l^{-1}; but on examination they will be found to express a physical ratio of some kind. For example, the unit of curvature has the dimension l^{-1}; it is expressed by radian per foot. The reciprocal unit is foot per radian, having the dimension l; it is not a measure of length, but of flatness.

The difficulty experienced in expressing the intensity of a candle or other spherical source arises from the want of a name for the unit of solid angle. Just as the natural unit for plane angle is metre of arc per metre of radius, so the natural unit for solid angle is square metre of spherical surface per metre of radius squared. The name "radian," given to the former unit (Everett's "Units and Physical Constants," 1879), has been very useful in expressing exact ideas; a recognized name for the latter unit would also be highly useful. For this purpose the word "steradian" was introduced by Dr. Halsted in his "Metrical Geometry" in 1880, and I have used it in my work on "Physical Arithmetic." Though not faultless from the point of view of the etymologist, it is sufficiently expressive to the physicist.

How then is the unit of illumination properly expressed? Suppose that by "bougie" is meant the current of light which streams from a uniform standard candle through one "steradian," then the illumination anywhere may be expressed in terms of bougie per square metre, where the former component refers to the current, and the latter to the cross-section. But in the case of light streaming from a point source, the illumination may be expressed in terms of bougie per steradian (steradian per square metre), where the former component refers to the intensity of the source and the latter to the solid angle subtended at the source by one square metre of cross-section. If "lux" is the single term for this unit, we have

lux = bougie per square metre
= (bougie per steradian)-(steradian per square metre).

Hence, candle per square foot or (candle per steradian)-(steradian per square foot) is the proper expression for the candle-toof-toof of the *Electrician*.

According to the above definition of "bougie," the total current from the candle would be 4π "bougies." But if "bougie" is defined to mean the total current from the candle, and by "lux" is meant the same quantity as before, we should have

$$\text{lux} = \frac{1}{4\pi} \text{ bougie per square metre.}$$

We cannot logically avoid the 4π. Exclude it from the source it appears in the intensity, and *vice-versa*. This point is overlooked in the established system of magnetic units, and forms the basis of Heaviside's rational system.

The use of the hyphen to denote a product unit is not very appropriate, for it suggests the sign minus rather than the sign of a product. It would be better if it were omitted altogether and the two component units amalgamated as in footpound and kilogram-metre; for then the nomenclature would correspond to the algebraic convention which leaves the sign × to be understood, and in addition to the hyphen would be set free to denote any compound unit other than the product or quotient.

If we consider the general subject of radiation we shall be led to distinguish the following ideas with their corresponding units:

TABLE I.

Idea.	C. G. S. Unit.
1. Quantity of radiant energy	Erg.
2. Current	Erg per sec.
3. Strength of source	Erg per sec.
4. Intensity of spherical source	Erg per sec. per steradian.
5. Intensity of cylindrical source	Erg per sec. per (cm.-radian).
6. Intensity of plane source	Erg per sec. per cm.^{2}.
7. Density of source	Erg per sec. per cm.^{2}.
8. Intensity of current	Erg per sec. per cm.^{2}.
9. Time flow	Erg per cm.^{2}.

Quantity of radiant energy of whatever kind can be expressed in ergs, and a flow in ergs per second. By strength of source is meant the whole quantity of radiant energy which leaves the source in a given time divided by the time; the appropriate unit is erg per second. The intensity of source is differently expressed, according as the radiation is spherical, cylindrical or plane. In the first case it is the ratio of a current through a solid angle to the solid angle, and hence it is appropriately measured by the erg per second per steradian. In the second case it is the ratio of a current through a wedge angle to the wedge angle. There is no recognized unit of wedge angle, as it involves the radian in one plane and a length along the perpendicular to that plane; it may be expressed by cm.-radian. Hence the intensity will be expressed in erg per second per (cm.-radian). If the radiation proceed from an infinite plane its intensity is measured in terms of erg per second per cm.^{2}.

By the density of the radiation at any point of a source is meant the ratio of the flow normal to a small surface to the small surface, and is expressed in terms of erg per second per cm.^{2}. By intensity of current anywhere is meant the ratio of the flow through a small cross-section to the cross-section, and is also expressed in terms of erg per second per cm.^{2}. By time flow is meant the ratio of the energy which has passed through a cross-section to the cross-section; it is expressed in terms of erg per cm.^{2}.

TABLE II.

Idea. French.	Idea. English.	Unit.	Symbol.
1. Quantité de lumière	Quantity of light	Rad.; lumen-hour.	Q
2. Flux lumineux	Luminous flux	Lumen	F
4. Intensité lumineuse	Luminous intensity	Pyr.	I
7. Radiation intrinsèque	Intrinsic radiation	Lumen per cm.^{2}.	R
8. Eclairement	Illumination	Lux	E
9. Illumination	Quantity of illumination	Phot.	J
Eclat intrinsèque	Intrinsic brightness	Pyr per cm.^{2}.	E

The above is the appropriate system of C. G. S. units for any kind of radiation measured simply as energy. But in the case of light the eye exercises a selective power, not only singling out a certain range of wave lengths, but discriminating among them as to amount. If one of the units is defined with reference to this discrimination exercised by the eye, then the other units of the light system can be defined in terms of it and the units of length and time.

Recently M. Blondel has published (*La Lumière Electrique*, July 7, 1894) an ingenious and logical system of units of light with corresponding practical units. When the ideas are arranged in the same order as in Table I, we obtain the system exhibited in Table II.

By "pyr" is meant a luminous intensity equal to one-twentieth part of the luminous intensity of the Violle standard. By "lumen" is meant the current of light through a steradian, the spherical source having a uniform intensity of one pyr; that is, lumen = pyr-steradian.

By "lux" is meant the illumination produced by a current of one lumen falling perpendicularly on a surface of one square metre; hence, lux = lumen per square metre.

The idea of No. 9 is expressed in French by illumination, but this word in English means éclairement; hence it has been proposed by M. Hospitalier to introduce "lumination" into both the French and the English languages to express the idea in question.

The "phot" is defined as equivalent to "lux second." By "rad" is meant the unit of quantity of light. It is defined by rad = lumen second just as the coulomb is defined by coulomb = ampere second.

The "phot" and the "rad" are said to be of special use in photography. But it may be asked whether the actinic system of units is not independent of the optical system. Is not the "pyr" then defined by the actinic effect instead of the optical effect? If so, we have two complete systems of units, both different from but parallel to the radiant energy system.

M. Blondel does not introduce Nos. 3 and 5. Let "bougie" denote a spherical source having a uniform intensity of one pyr; then we would have bougie = 4π lumens.

The symbols given in the last column of Table II have been proposed by M. Hospitalier, and he asks for criticisms. In the system of symbols and abbreviations recommended by the congress, all quantities are denoted by oblique letters or script letters, and units and abbreviations for units by perpendicular letters. The proposed symbols from their perpendicular character will not harmonize well with the other symbols of quantity. Also they are already in use to denote vector quantities.

A Flutter in a Contemporary's Office.

Four well-known houses — the Armington & Sims Engine Company, the McIntosh & Seymour Engine Company, the Okonite Company, Limited, and the Law Battery Company—have discontinued their advertisements in the *Electrical World*. The impertinent circulars issued from that office did it. The proprietor, W. J. Johnston, with a record of three failures in the past, with a sawdust periodical in the present and a challenge ringing in his ears to produce a few paying subscribers, sends out a pathetic card headed:

"'Tis the wounded bird that flutters."

Poor flutterer!

A FEW WORDS ON "CARRYING CAPACITY" OF CONDUCTORS.

BY J. E. TALBOT.

One often hears the inquiry "What is the carrying capacity of such and such a wire?" without giving it much thought; perhaps usually for the reason that in many cases the underwriters' regulations settle the matter for us, and because in most instances the size of a conductor is determined by other considerations. It is, however, not so very long since even the insurance authorities had no published standard for the size of wires, and the "safe carrying capacity" of a wire was "the current which it will convey without becoming painfully warm when grasped for a minute in the closed hand" (N. Y. Rules, Feb. 27, 1889). This was manifestly too vague, and in other rules a list of allowable capacities was given for "wires exposed to the air," accompanied by a statement that the carrying capacity of *enclosed* wires would be reduced "about 40 per cent." The Edison company employed a table giving the "maximum safe carrying capacity," allowing a larger current than is now usual. Various formulæ and rules were used in determining the proper size of wires, when this was not controlled by more important considerations. Many of these were not practically available for use on account of their requiring the determination of some undeterminable factor of radiation or convection. It became necessary to crystallize the results obtained by various investigators into some convenient working rule for every-day use. The difference of opinions obtaining as to what was safe may be judged by the fact that we find, on reducing the various rules to the basis of the current that might be properly carried by a round copper rod of one-half inch in diameter, figures running all the way from 63.5 amperes to 357 amperes. The two extreme figures must, however, have been due to some special consideration, as seven others from good authorities vary only between 143 amperes and 212 amperes, with an average for the seven of 193, which very nearly corresponds (allowing for temperature and relative purity) with the current density now allowed by the rules of the Underwriters' National Association, 175 amperes for 0000 Brown & Sharpe. This also nearly corresponds with a current density of 1,000 amperes to the square inch, and for a rise of temperature of, speaking roughly, 20 degrees Fahrenheit.

Mr. A. E. Kennelly has devoted much time and labor to this question, and is justly regarded as an authority. His formula for insulated house wire, allowing an increase of temperature of 180 Fahrenheit, is $\left(\frac{d^2}{216}\right)^{3/4}$ or (as given by Hospitalier) for the diameter expressed in millimetres, $4.375d^3$, equals the current to be allowed.

A rule considerably used has been that of 1,000 circular mils per ampere, but this is only suitable for round conductors and allows, of course, a conductor only 0.7854 of the size required by the 1,000 amperes per square inch rule, which latter agrees best with the best authorities, and is more consistent with the underwriters' allowance, erring, however, a little on the side of conservatism and safety. This surely is a failing which "leans to virtue's side."

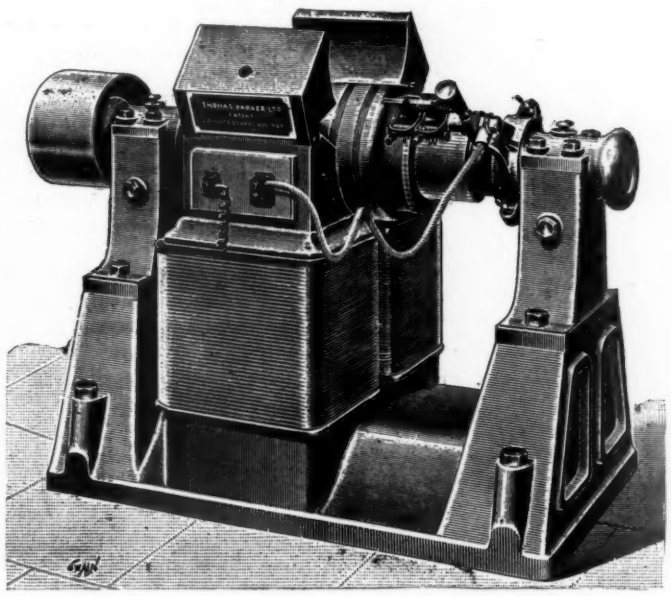
The tendency has been of late to be more and more liberal in the use of copper, and the slightly increased cost in metal is amply repaid by improvement in results.

The rule of allowing 1,000 amperes per square inch has the further convenience as a matter of calculation that the cross-section expressed in decimals of an inch at once gives the current in amperes by merely mentally shifting the decimal point, thus 000 Brown & Sharpe has a cross-sectional area of .1317 of an inch—current equals 132 amperes.

It would, therefore, seem that we are now so near definiteness of expression on this subject that "carrying capacity" means or implies a current density of 1,000 amperes per square inch, involving an increase in temperature of about 20 degrees Fahrenheit. It is true that the underwriters' table forms a convenient and probably safe rule, but it is not universally applicable and is not so readily carried in the head. Besides which it is more or less arbitrary in its nature and subject to change in the future as in the past.

In connection with this subject it is interesting to remember that the heating limit is sometimes reached before the limit of permissible drop in voltage, and sometimes the reverse is the case. Thus for 50 amperes to be carried 500 feet with five volts drop a 0 wire is required, which is very much larger than necessary on the ground of heat, while 100 amperes, 50 feet, for a loss of two volts only needs a No. 2 wire on the ground of loss, which falls short of the required capacity as to heat.

There are other cases to which the usual rules can hardly be applied, such, for example, as the designing of central station instruments and switches, and the calculation of bus bars and other conductors. The advantages supposed to be derived in this connection from freer radiation to the air are largely counterbalanced by the fact that the air in a station is usually already pretty hot and does not have the cooling effect which would be produced by the external atmosphere. The rule of 1,000 amperes per square inch of cross-sectional area it is thought, however, will still apply with good results, but here it is usually poor contacts at joints and terminals of switches and elsewhere that produce most of the heating effects. Let us not, however, add to them by parsimony in copper. It is admitted that on the line there are individual and temporary losses that are higher than any station loss is likely to be, but they are scattered, only exist for a time, and heating effects have better opportunities for dissipation, while in the station we have with us "all the current, all the time." When we remember that, in a 1,000 ampere switch or other conductor, the difference of $\frac{1}{1000}$ of an ohm in resistance signifies one kilowatt multiplied by the hours in a day and the days in a year, a very short calculation will suffice to warn us, not only on the ground of actual heat, but of economy also, against the proverbial "penny wisdom."



PARKER'S NEW CONTINUOUS CURRENT DYNAMO, THE POLES BEING SHOWN TURNED BACK.

A Kind Word From a Courtly Gentleman.

TO THE EDITOR OF ELECTRICAL REVIEW:

Some person has said, "If you would pass through the door that leads to prosperity, you will find it marked 'Push.'"

From my acquaintance with the ELECTRICAL REVIEW, from its preliminary inception, I am aware it has "pushed," passed through the door, and you have my best wishes for continued success and prosperity.

Very truly yours,

GARDINER C. SIMS.

A New Design of Continuous Current Dynamo.

The engineering works of Messrs. Thomas Parker, Limited, Wolverhampton, England, have developed the new design of direct current dynamo shown in the accompanying illustration, which is from the London *Electrical Engineer*.

One of the novel and special features of this dynamo is the fact that the pole pieces are cut through and hinged, so that they can be turned back to allow of examination or taking out of the armature by a direct vertical lift, and without unsetting the bearings. The hinge is placed at the angle of the pole piece, so that when turned back halfway the magnet ferrule can be lifted off (after the armature has been removed) without uncoupling the hinged piece. This arrangement allows of machines being fixed in confined spaces, which would not be suitable with the ordinary type of machine, where the armature has to be threaded in to or out of the magnets. There is also considerably less risk of damage in withdrawing or replacing the armature.

An oil well is provided in the pedestal underneath the bottom of the bearing (the bottom bearing being continuous); a ring runs in this well and over the top of the shaft, giving continuous lubrication. Where machines are coupled direct to high speed engines the armatures are arranged at the bottom, the pole pieces in this case also being cut through, so that the upper portion of the magnets can be lifted away and the armature then lifted out. The armatures of these machines are coil wound under the Eickemeyer patents, and by means of these new arrangements the putting in or taking out of an armature is rendered not only much more simple, but it also occupies far less time than is required by the old method.

MOONLIGHT SCHEDULE FOR FEBRUARY, 1895.

PREPARED AT PRINCETON COLLEGE FOR THE "ELECTRICAL REVIEW."

Night of Febr'y.	Latitude 41°. New York, Chicago, Denver.	Latitude 33°. Atlanta, Los Angeles.	
1-2	11.42 P. M.	11.34 P. M.	Light.
2-3	12.51 A. M.	12.37 A. M.	"
3-4	2.01 A. M.	1.42 A. M.	"
4-5	3.12 A. M.	2.49 A. M.	"
5-6	4.20 A. M.	3.55 A. M.	"
6-7	5.18 A. M.	4.56 A. M.	"
7-8	Full Moon.—No Light.		
8-9			
9-10			
10-11	7.26 P. M.	7.26 P. M.	Extinguish.
11-12	8 40 P. M.	8.33 P. M.	"
12-13	9.59 P. M.	9.44 P. M.	"
13-14	11.13 P. M.	10.50 P. M.	"
14-15	12.27 A. M.	11.56 P. M.	"
15-16	1.40 A. M.	1.04 A. M.	"
16-17	2.50 A. M.	2.08 A. M.	"
17-18	3.54 A. M.	3.09 A. M.	"
18-19	4.48 A. M.	4.02 A. M.	"
19-20	5.31 A. M.	4.48 A. M.	"
20-21		5.27 A. M.	"
21-22	New Moon.—Run all Night.		
22-23			
23-24			
24-25			
25-26		6.40 P. M.	Light.
26-27	7.29 P. M.	7.35 P. M.	"
27-28	8.28 P. M.	8.28 P. M.	"
28-1	9.34 P. M.	9.26 P. M.	"

The New England Telegraph and Telephone Company has declared a dividend of $1 per share, payable February 15 to stock of record January 31. Books close February 1 to February 15, both days inclusive.

ELECTRIC RAILWAY NOTES.

Officers of electric railway companies are requested to send promptly to the ELECTRICAL REVIEW *notices of meetings, election of officers, declarations of dividends, financial reports and all items of interest in connection with the financial and practical operation of their roads.*

The owners of the Greensburg, Pa., Electric Street Railway have about decided to accept $48,000 for the line.

The officials of the Staten Island, N. Y., Rapid Transit Company are considering the advisability of changing their motive power from steam to electricity.

The Cincinnati Street Railway Company last week sold 100 horses and mules in consequence of its Sixth street line having been electrically equipped.

After being without street car service for over a year, the people of Battle Creek, Mich., can ride after February 1, when the electric railway will again be put in operation.

Vice-Chancellor Bird on January 22 denied the application of S. K. Wilson for the appointment of a receiver for the Trenton, N. J., Passenger Railway Company. The court held that the company was not insolvent, but, on the other hand, was free from debt.

By the sale of the Gettysburg Electric Railway that property has passed into the hands of people who are expected to build the northern link in the chain of electric railroads that are to extend, from a connection with the traction system, from Baltimore to Gettysburg. The distance over this route will be 50 miles, while the shortest steam railroad is 72 miles.

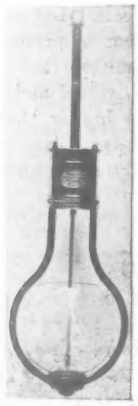
The General Electric Railway Company was incorporated last week at Springfield, Ill., with a capital stock of $5,000,000. The company proposes to build and operate an extensive electric street railway system in Chicago, employing a new and improved underground trolley system recently invented and patented by Henry Bradenburg, a Chicago inventor. The moneyed men behind the scheme remain in the background. Prominent railway officials are said to be interested, and a mysterious "New York man," who has taken a large share of the stock, is said to be Charles T. Yerkes.

At last week's meeting of the Jersey City, N. J., Board of Aldermen, Alderman Witter introduced an ordinance providing "that each and every motorman now or hereafter employed by any electric railway company in Jersey City shall be an actual resident of Hudson County for at least one year at the time of his appointment, and shall not be employed in such capacity without first having obtained a license therefor, the license to run for one year and cost the sum of $1," and "that any person who shall be employed contrary to the provisions of this ordinance shall suffer a penalty not exceeding $5 for each offense."

The "Wood" Arc Lamps.

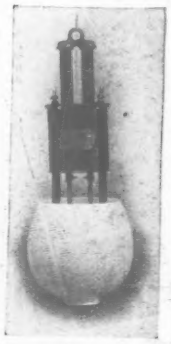
The Fort Wayne Electric Corporation, Fort Wayne, Ind., are manufacturing arc lamps for any candle-power for use on constant current, constant potential and alternating current circuits. Several styles of these lamps are shown in the accompanying illustrations. The lamps are made either gear or clutch feed. They are ornamental in appearance, as well as perfectly automatic in operation. They are fitted with hand cut-out, automatic cut-out, automatic re-lighter and automatic short circuit, which cuts them out of circuit as soon as the carbons are consumed, and

DOUBLE LONG LAMP.



SINGLE LONG LAMP.

SINGLE SHORT LAMP.



DOUBLE SHORT LAMP.

STYLES OF "WOOD" ARC LAMPS.

allows both single and double lamps to be operated in the same circuit with perfect safety. They are also fitted with an ash cup to facilitate cleaning, as well as to prevent the possibility of carbons dropping from the holders through carelessness or otherwise. The framework is constructed in such a manner as to be substantial, as well as ornamental in appearance. It is also weather-proof, and perfectly insulated from the circuit. The binding posts are fitted with hooks to enable the lamp to be suspended from a hangerboard, in addition to the suspending ring on the frame.

In installing these lamps on constant potential, incandescent or alternating current circuits, they do not require an extra rheostat, switch and fuse box. All the devices required are contained in either the hangerboard or lamp, and all that is needed is to run the wires from the line to the hangerboard, and hang the lamp.

The company also makes a single lamp for all-night lighting which uses elliptical carbons, and has become very popular on account of its simplicity. The "Wood" alternating arc lamp is claimed to be the only arc lamp in existence that successfully burns ordinary carbons. It is said to give the same candle-power per watt that can be produced by the best constant current lamp.

TELEPHONE NEWS AND COMMENT.

Upper Sandusky, Ohio, is to have an independent telephone exchange.

A telephone line is to be erected between Oak Hill and Middleburgh, N. Y.

About 43 private telephone wires are leased by Boston men between Boston and New York.

A bill has been introduced in the legislature of Minnesota which proposes to reduce telephone rates in that State about 50 per cent.

Patent Attorney George W. Hey, of Syracuse, N. Y., has invented a new automatic telephone switchboard, which may soon be placed upon the market.

The Central New York Telephone and Telegraph Company has issued its official list of subscribers No. 9, giving the alphabetical list for Utica and Syracuse.

Notwithstanding the dull times the Erie Telegraph and Telephone Company shows a net gain of 770 subscribers for the fiscal year ending December 31, as against 107 for 1893.

To prevent the possibility of contagious diseases spreading through the use of the telephone the Paris Faculty of Medicine recommends the use of a specially prepared antiseptic paper.

A reduced schedule of party line yearly rates for telephone exchange connection has been adopted for exchange service outside of Boston and suburban exchanges, to take effect February 1.

The output of the American Bell Telephone Company for the month ending January 20, 1895, was as follows:

	1894-5.	1893-4.	Inc.	Dec.
Gross output...	7,631	4,453	3,178	....
Returned	5,945	6,688	....	743
Net output...	1,686	def. 2,235	3,921	....

The Newark, Ohio, Telephone Company has contracted with the Western Telephone Construction Company, of Chicago, to build its new plant. The new company is reported to have over 200 subscribers.

Experts are in Syracuse, N. Y., drawing plans for a telephone subway system. The Central New York Telephone and Telegraph Company has just acquired title to property on Montgomery street, Syracuse, on which a new exchange building will be erected at once.

Mr. W. L. Burdick, of Syracuse, N. Y., is the efficient division superintendent of the Central New York Telephone and Telegraph Company, and will have immediate supervision of the extensive new work in the way of burying the wires and erecting a new exchange in that city.

The officers of the Rocky Mountain Bell Telephone Company are George Y. Wallace, president; George M. Downey, vice-president; H. C. Hill, secretary; C. W. Lyman, treasurer; and D. S. Murray, general superintendent. The general offices of this company are at Salt Lake City, Utah, and their territory extends over Utah, Idaho, Montana and Wyoming.

It is reported that the Troy, N. Y., Telephone and Telegraph Company will not declare a dividend at the annual meeting, February 11. It has been able to declare a dividend of only two per cent. in four years. The blizzard in 1891 damaged the lines to the extent of $70,000. The new switchboard and other improvements last year cost $30,000, and, as a consequence, it is expected that no dividend will be paid.

The new telephone company now being organized in Atchison, Kan., reports that it already has 150 subscribers, but it will not commence operations until 300 names are secured. Its prices are $25 per year for instruments. F. M. Baker is president and J. W. Sharard is treasurer of the new company. They will use the Harrison telephone. The Missouri and Kansas Company has 250 subscribers in Atchison.

The new graphophone that is employed to attend to part of the conversation in the central telephone office may be all right, but it lacks that distinctive tone which tells to the experienced listener whether or not Miss Switchboard's best young man took her to the theater last night and whether he is now buying pinks instead of roses. Modern invention is doing more and more to make life monotonous.—*Charlestown, Mass., Enterprise.*

The course of telephone stocks during the month was downward, owing to the Berliner decision. This was reflected directly by a drop of some 10 points in American Bell, and to a less degree in the others. A comparative table of bid and asked prices follows:

	JANUARY 15.		DECEMBER 15.	
	Bid.	Asked.	Bid.	Asked.
Bell.....	187½	180	198½	199
Erie.....	53¾	54	51⅝	...
Hudson River.....	45	50	40⅛	45
Mexican.....	60	70	70	75
N. Y. and N. J.....	95½	..	97⅛	98½
New England.....	68	68¼	66	66⅛

The Michigan Bell Telephone Company, on January 17, moved its Detroit exchange from the Newberry building to the new telephone building at Clifford and Griswold streets. The entire service was transferred in less than 20 minutes, the change being made at noon. The new switchboard cost $145,000. The new operating room is 60x96 feet and the big switchboard is 127 feet in length, contains 5,400 numbers and is at present occupied by 59 girls, who operate 4,300 numbers, the present list of subscribers. The wonderfully rapid progress of the service in Detroit can be understood when it is stated that in 1880, when the exchange was moved to the old "central" in the Newberry building, there were but 300 subscribers.

BROOKLYN'S GREAT TROLLEY STRIKE.

IT CONTINUES FOR ANOTHER WEEK WITH MUCH DISORDER AND A GREAT DEAL OF WIRE CUTTING —INSUFFICIENT POLICE PROTECTION PERMITS MOBBING OF NEW MOTORMEN AND CONDUCTORS—THE COMPANIES OPERATE ABOUT HALF THEIR LINES AND GRADUALLY FILL ALL VACANCIES.

The strike in Brooklyn continued all last week on the three trolley systems, known as the Brooklyn Heights, Atlantic Avenue and Broadway. The events of the week were quite similar to those of the previous week, except that the losing strikers and their sympathizers commenced to cut the feeder and trolley wires at numerous important points. This greatly interfered with the service, and the delay was increased by the leaders of the strike calling out the linemen, but less than half responded. The wire cutters would perform their rascally work in the early morning hours, generally about 3 o'clock, and easily escape. Towards the end of the week the police were able to make several arrests and found striking motormen and conductors engaged in the work. In one case a special policemen, who had thrown up his job, was caught cutting wires.

The aldermen of the city, as evidence of their sympathy, passed an ordinance requiring the companies to employ only licensed motormen, who should be residents of Brooklyn. This act lacked legality, and nothing further was heard from it.

The strikers from the Atlantic avenue system, realizing that their case was about hopeless, as President Norton had more than enough men to take their places, asked that Mr. W. J. Richardson, the well-known secretary of the American Street Railway Association and an officer of the company, be selected as arbitrator. As President Norton announced there was nothing now to arbitrate, this suggestion failed.

On application of a merchant of Brooklyn, Judge Gaynor granted an alternative writ of mandamus to compel the companies to operate all their cars. The writ is returnable in 20 days. This decision was considered to be in favor of the companies, as the strikers had hoped it would be peremptory and order the full service to begin at once.

President Lewis, of the Brooklyn Heights company, announced Saturday that he had employed 2,000 new men, and about 800 had left through fear or persuasion. Also, that old employés would be taken back individually as long as vacancies existed. About 25 came back Saturday, and many others wrote that they wanted to return, but were afraid to do so on account of the personal danger they would be in from other strikers.

The two brigades of militia remained in the city, and were continually called on to suppress incipient riots and protect the power houses and lines of the companies. Every car carried a policeman, and some 600 special policemen were sworn in to assist in sustaining law and order.

The assaults on the new motormen and conductors were numerous and brutal. Several were found in the streets unconscious and disabled, having been assaulted on leaving the power houses or, as was often the case, being hauled off the cars at some unprotected point.

The two weeks of the strike ended Monday morning, January 28, with a record of two lives lost—one a drunken workman from New York who was shot while trying to pass the picket line of the Seventh regiment, and the other a roofer who was thought to be stoning the Thirteenth regiment. He did not obey when told to get back and was shot by a sharp shooter and fell back on the roof where he was at work, dying in a few hours.

The Seventh and 71st regiments were ordered home Monday.

We are indebted to our esteemed contemporary Brooklyn *Life* for the excellent portraits on this page.

The strikers commenced applying for their old positions Monday, and it is evident that the strike is over, after a disastrous life of 15 days.

PRESIDENT BENJAMIN NORTON, OF THE ATLANTIC AVENUE RAILROAD COMPANY, BROOKLYN, N. Y.

PRESIDENT DANIEL F. LEWIS, OF THE BROOKLYN HEIGHTS RAILROAD COMPANY, BROOKLYN, N. Y.

GENERAL NOTES.

A bill has been introduced in the West Virginia Legislature providing for the electrocution of murderers.

R. L. Day & Company, of Boston, will sell at auction, February 9, by order of the directors, 3,368 shares American Bell Telephone Company stock in lots of 50 or more.

It is reported that the Westinghouse Electric and Manufacturing Company last week secured an order for 269 railway motors from the West End Street Railway Company, of Boston.

PERSONAL.

The Hon. John C. Burke, of the law firm of Marshall, Burke & Marshall, has recently been elected to the presidency of the Bradbury-Stone Electric Storage Company, of Lowell, Mass.

Secretary J. S. Crider, of the Washington Carbon Company, Pittsburgh, was a recent visitor to New York. Mr. Crider reports a great demand for the new "Helios" cored carbons.

Increasing Demand for Insulated Wires and Cables.

The growth of the insulated wire and cable business of this country is something stupendous. Immense factories devoted exclusively to the manufacture of this product are to be found in all parts of the country, and, notwithstanding the stringency of the times, have been running full time, and in many instances overtime. This condition is to be particularly noticed with those manufacturing houses that have kept their name and material constantly before the public, realizing that every day new people are attracted to the electrical field and new investments made by consumers who will soon be seeking supplies. During the last two weeks one well-known company—the Okonite—has delivered submarine cables to the lucky number of thirteen. Six of these cables were for telephone companies and seven for electric railways. In addition, this company is doing a large business with the electric light companies, where their product is particularly profitable. At their large factories at Passaic, N. J., they are running full time, and in several departments are compelled to work overtime.

It does look like business was improving and that the alert consumer was fully appreciating the number one material that the Okonite company has the well-deserved reputation of always turning out.

TELEPHONE RATES.

The improved New York City Exchange Telephone Service, metallic Circuit Lines, long distance equipment, is now offered by us at rates which bring it within reach of even the most moderate users. The prices per year are as follows:

Combination Line, $80.00
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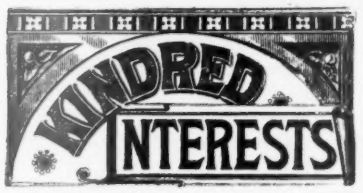


W. R. Brixey, 203 Broadway, New York, manufacturer of the well-known "Kerite" wires and cables, reports that several large orders have come in during the first weeks of 1895. Judging from present prospects, 1895 will be a good business year for this firm.

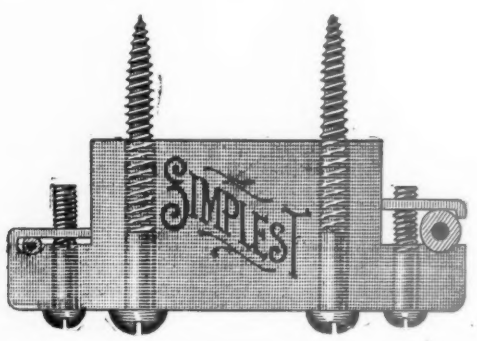
The Storey Motor and Tool Company, manufacturers of the "Storey" motor and dynamo, whose headquarters has heretofore been located in New York city, announces that hereafter its main office will be at the factory in Philadelphia, corner of York street and Sedgeley avenue. A New York office will, however, be maintained at 120 Liberty street, with Mr. N. M. Garland in charge.

The new power house for the Hartford Street Railway Company is now completed and is said to be one of the finest, if not the finest, in the New England States. It is 66 feet wide and 230 feet long, entirely fireproof, no wood work at all having been used about the building. It was designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and is covered with their patent anti-condensation corrugated iron roofing.

The Electric Heat Alarm Company, 145 High street, Boston, Mass., has developed a novel and what promises to be a valuable specialty in the "Simplest" cleat, which has been very favorably indorsed. Its various features are described in another place on this page. Send for a sample cleat and see for yourself what it is like. This company has also issued its new descriptive catalogue No. 4, which covers automatic fire alarms, automatic journal bearing alarms, hotel call and fire alarm system, and automatic alarms for grain elevators, coal bunkers, warehouses, etc.

The American Electrical Works, of Providence, a company with an unsurpassed record for high-grade manufacture, is starting the new year with some splendid orders. President Phillips, of this company, is not given to announcing the extent of the success of the American Electrical Works, but the ELECTRICAL REVIEW has it on satisfactory authority that the company has orders to fill that will require hard work for many days and probably nights. Mr. P. C. Ackerman, the worthy New York representative of this house, is now on his annual tour, helping out the numerous friends of his company in all parts of the United States by taking their orders.

Mr. Foree Bain, an electrical engineer well known in the South and West, has opened an office in suite No. 1657, 58 and 59, Monadnock building, Chicago, and extends a cordial invitation to all of his friends to call on him. He is making a specialty of designing machinery in which electricity is applied to new uses to hasten and cheapen the process of manufacture in the industrial arts. He has also devoted considerable time and is meeting with success as an expert in patent causes. He reports that he is not connected with any manufacturing company, and, therefore, his judgment and opinions may be depended upon as unbiased and free from any prejudice that might otherwise exist. Mr. Bain has our wishes for success.



THE "SIMPLEST" CLEAT.

The "Simplest" Cleat.

The accompanying illustration shows a new porcelain cleat just put on the market by the Electric Heat Alarm Company, 145 High street, Boston, Mass. It is called the "Simplest" cleat for the following reasons: It is in one piece, it anchors the wire, there is no breakage, it does not cut or bend the wire, it can be put up independently of the wire, it gives perfect insulation, it is practical for nearly all sizes of wire and it will bind two sizes of wire. It is reported that actual tests have shown the "Simplest" to be a better insulator than any two piece clea

This cleat has been patented by Mr. L. H. Des Isles, foreman of the Electric Heat Alarm Company's shops. The company is very anxious to have the opinion of practical men on this cleat and will send samples and prices to any one on request.

Sight Feed Oil Cups. AUTOMATIC "WIPING DEVICE" For oiling Crank and Cross-head Pins. WM. H. WILKINSON, 352 Atlantic Ave., Boston, Mass.

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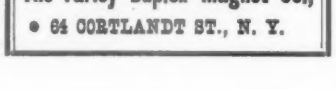

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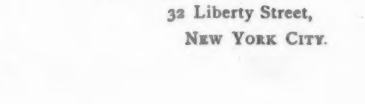

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